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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
08/893,917	07/11/97	LITTAU K	AM2119/T2130

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EXAMINER	
ZERVIGON,R	
ART UNIT	**PAPER NUMBER**
1763	11

DATE MAILED: 03/10/00

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

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Office Action Summary

Application No.	Applicant(s)
08/893,917	Littau et al
Examiner	**Group Art Unit**
Rudy Zervigon	1763

☒ Responsive to communication(s) filed on *Dec 27, 1999*

☒ This action is **FINAL.**

☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire *3* month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claim

☒ Claim(s) *1-21* is/are pending in the applicat

Of the above, claim(s) _____ is/are withdrawn from consideration

☐ Claim(s) _____ is/are allowed.

☒ Claim(s) *1-21* is/are rejected.

☐ Claim(s) _____ is/are objected to.

☐ Claims _____ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☐ All ☐ Some* ☒ None of the CERTIFIED copies of the priority documents have been

☐ received.

☐ received in Application No. (Series Code/Serial Number) _____.

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: _____

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

☐ Notice of References Cited, PTO-892

☒ Information Disclosure Statement(s), PTO-1449, Paper No(s). *5*

☐ Interview Summary, PTO-413

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

--- SEE OFFICE ACTION ON THE FOLLOWING PAGES ---

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless --
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1-4,6,8,9,11-15,21 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Kawamura (U.S. Pat. 5,328,558). Kawamura describes a dry etching apparatus using a method for etching silica film with the use of a gas (column 1, lines 1-2). Specifically, the limitations set forth in the rejected claims are explicitly detailed by Kawamura:

a. Remote plasma formation (column 3, lines 50-60) relative to substrate processing chamber (Column 4, lines 13-18).

b. Diluent gas flow (column 3, lines 59-66) forming a mixture of reactive radicals and diluent gas anterior to a wafer processing chamber (Column 4, lines 13-18).

c. Total pressure (comprising diluent gas and plasma gas) less than 1 Torr (column 4, lines 24-25, column 5, lines 63-64, column 6, lines 2-4)

d. The dependance of the rate at which a chamber residue gas is exhausted compared to the rate of a diluent gas flow is implicitly described according to the geometry of the piping as described by Kawamura. Accordingly, Kawamura's chamber residue gas is exhausted

depending on the rate of a diluent gas flow that arrives in the processing chamber. A common assumption in fluid dynamics is that most fluids are incompressible, and for a constant processing chamber pressure to be established, fluid continuity equations dictate that, at steady-state, the flow into the processing chamber must equal the flow from the processing chamber.

3. Claims 1-15,21 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Moslehi (U.S. Pat. 5,403,434). Moslehi (U.S. Pat. 5,403,434) describes a low temperature in-situ dry cleaning etching apparatus and method with the use of a gas (column 1, lines 13-24). Specifically, the limitations set forth in the rejected claims are explicitly detailed by Moslehi (U.S. Pat. 5,403,434):

e. Remote plasma formation (column 9, lines 6-10) relative to substrate processing chamber (Column 9, lines 10-17).

f. Diluent gas flow (column 11, lines 37-44) forming a mixture of reactive radicals and diluent gas anterior to a wafer processing chamber (Column 9, lines 10-17).

g. Total pressure (comprising diluent gas and plasma gas) less than 1 Torr (column 3, lines 16-20)

h. Diluent gas flow comprises a reduction gas, in this case hydrogen (column 11, lines 37-44).

i. Fluorinated gases (column 4, lines 31-36)

j. The dependance of the rate at which a chamber residue gas is exhausted compared to the rate of a diluent gas flow is implicitly described according to the geometry of the piping as described by Moslehi. Accordingly, Moslehi's chamber residue gas is exhausted via pumping

system (item 30, Figure 1) depending on the rate of a diluent gas flow that arrives in the processing chamber. A common assumption in fluid dynamics is that most fluids are incompressible, and for a constant processing chamber pressure to be established, fluid continuity equations dictate that, at steady-state, the flow into the processing chamber must equal the flow from the processing chamber.

k. Relative gas flow rates for the diluent gas (hydrogen) and the plasma forming gas (Ge_2H_6) meeting the claim 7 limitation is explicitly met (column 10, lines 53-59).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 16-20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kawamura (U.S. Pat. 5,328,558) or Moslehi (U.S. Pat. 5,403,434) in view of Stevens et al (U.S. Pat.5,302,803). The apparatus and methods of Kawamura (U.S. Pat. 5,328,558) and Moslehi (U.S. Pat. 5,403,434) have been discussed above. Kawamura (U.S. Pat. 5,328,558) and Moslehi (U.S. Pat. 5,403,434) do not specifically discuss microwave arresters and apertures with regards to their microwave plasma generation sources. Stevens et al discuss a microwave applicator using both an input aperture and output aperture with microwave arresters (column 9, lines 24-32).

It is the examiner's position that a person of ordinary skill in the art at the time the invention was made would have found it obvious to modify the Kawamura (U.S. Pat. 5,328,558) or Moslehi (U.S. Pat. 5,403,434) microwave sources by introducing Stevens et al's microwave applicator using both an input aperture and output aperture with microwave arresters (column 9, lines 24-32). The Stevens et al microwave applicator design using both an input aperture and output aperture with microwave arresters (column 9, lines 24-32) is a common practice in the art limiting the extent of microwave permeation to the volume of gas intended for discharge.

Response to Arguments

6. Applicant's arguments filed December 27, 1999 (paper 10) have been fully considered but they are not persuasive. Specifically, the applicant's claim whereby "none of the references disclose or suggest a method or an apparatus for mixing a flow or reactive radicals and a diluent gas flow anterior to a chamber to form a gas-radical mixture" (page 6, paper 10) is inaccurate. As cited in the second action on the merits, Kawamura describes a dry etching **apparatus using a method** for etching silica film with the use of a gas (column 1, lines 1-2). Specifically, the limitations set forth in the rejected claims are explicitly detailed by Kawamura:

1. **Remote plasma formation** (column 3, lines 50-60) **relative to substrate processing chamber** (Column 4, lines 13-18).

m. ***Diluent gas flow (column 3, lines 59-66) forming a mixture of reactive radicals and diluent gas anterior to a wafer processing chamber (Column 4, lines 13-18).***

n. Total pressure (comprising diluent gas and plasma gas) less than 1 Torr (column 4, lines 24-25, column 5, lines 63-64, column 6, lines 2-4)

o. The dependance of the rate at which a chamber residue gas is exhausted compared to the rate of a diluent gas flow is implicitly described according to the geometry of the piping as described by Kawamura. Accordingly, Kawamura's chamber residue gas is exhausted depending on the rate of a diluent gas flow that arrives in the processing chamber. A common assumption in fluid dynamics is that most fluids are incompressible, and for a constant processing chamber pressure to be established, fluid continuity equations dictate that, at steady-state, the flow into the processing chamber must equal the flow from the processing chamber.

Additionally, residue removal, as claimed in claim 1 from which claims 2-4 and 6 depend and argued by the applicant, is inherent in the Kawamura apparatus. After cycling through processing operations, the well established inherent knowledge that "residue from a substrate processing chamber" would be at least partially if not fully removed, say through a cleaning stage well known in the art, is well embodied by the Kawamura apparatus and method.

7. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies, specifically, "...producing the gas-radical mixture anterior of the chamber allows increasing the flow rate of a gas

through the chamber, while decreasing the rate at which materials located within the chamber are etched by the reactive radicals dispersed within the gas-radical mixture (page 4, lines 15-18)." are not recited in the rejected claim(s). ***Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims.*** See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

8. Applicant's arguments filed December 27, 1999 (paper 10) have been fully considered but they are not persuasive. Specifically, the applicant's claim whereby "none of the references disclose or suggest a method or an apparatus for mixing a flow or reactive radicals and a diluent gas flow anterior to a chamber to form a gas-radical mixture" (page 6, paper 10) is inaccurate. As cited in the second action on the merits, Moslehi (U.S. Pat. 5,403,434) describes a low temperature in-situ dry cleaning etching apparatus and method with the use of a gas (column 1, lines 13-24). Specifically, the limitations set forth in the rejected claims are explicitly detailed by Moslehi (U.S. Pat. 5,403,434):

p. Remote plasma formation (column 9, lines 6-10) relative to substrate processing chamber (Column 9, lines 10-17).

q. ***Diluent gas flow*** (column 11, lines 37-44) **forming a mixture of reactive radicals and diluent gas anterior to a wafer processing chamber** (Column 9, lines 10-17)

r. Total pressure (comprising diluent gas and plasma gas) less than 1 Torr (column 3, lines 16-20)

s. **Diluent gas flow comprises a reduction gas, in this case hydrogen** (column 11, lines 37-44).

t. Fluorinated gases (column 4, lines 31-36)

u. The dependance of the rate at which a chamber residue gas is exhausted compared to the rate of a diluent gas flow is implicitly described according to the geometry of the piping as described by Moslehi. Accordingly, Moslehi's chamber residue gas is exhausted via pumping system (item 30, Figure 1) depending on the rate of a diluent gas flow that arrives in the processing chamber. A common assumption in fluid dynamics is that most fluids are incompressible, and for a constant processing chamber pressure to be established, fluid continuity equations dictate that, at steady-state, the flow into the processing chamber must equal the flow from the processing chamber.

v. Relative gas flow rates for the diluent gas (hydrogen) and the plasma forming gas (Ge_2H_6) meeting the claim 7 limitation is explicitly met (column 10, lines 53-59).

Mixing of a flow or reactive radicals and a diluent gas flow anterior to a chamber to form a gas-radical mixture is anticapatory in view of Moslehi's (U.S. Pat. 5,403,434) cross connect branching off the nonplasma gas line (item 22. Figure 1). Gas manifolds (item 20, Figure 1) and pumping system (item 20, Figure 1) are additionally described by Moslehi's (U.S. Pat. 5,403,434) apparatus and method.

Conclusion

9. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Rudy Zervigon whose telephone number is (703) 305-1351. The examiner can normally be reached on a Monday through Friday schedule from 8am until 5pm. The official AF fax phone number for the 1763 art unit is (703) 305-3599. Any Inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Chemical and Materials Engineering art unit receptionist at (703) 308-0661.

THI DANG
PRIMARY EXAMINER
GROUP 1700